—Case Reports—

Frontal Musculocutaneous V-Y Island Flap for Coverage of Forehead Defect with a Dural Exposure after Craniotomy

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Abstract

We have performed forehead reconstruction with a frontal musculocutaneous V-Y island flap to establish skin and soft-tissue coverage for a cranial bone defect with dural exposure. A 56-year-old woman who had previously undergone craniotomy for aneurysm clipping had a severe infection of the bone flap and subsequently underwent partial resection. The skin defect and the underlying dead space on the dura was successfully covered with a frontal musculocutaneous V-Y island flap without complications. Because this flap shows technical feasibility in harvesting, stable blood supply, functional preservation of frontal muscle, and good texture and color match, it may be an ideal flap for forehead and frontal reconstruction of defects of small or moderate size when primary closure, skin grafting, or transfer of local pedicled flaps or free flaps is impossible.
(J Nippon Med Sch 2009; 76: 19–22)

Key words: frontal muscle, forehead reconstruction, craniotomy, flap

Introduction

Frontal or forehead skin defects associated with tumor abrasion, traumas and postoperative wound dehiscence are frequently encountered by plastic surgeons. A variety of reconstructive procedures for the repair of frontal or forehead defects have been described[1–5]. Although each procedure has inherent advantages and disadvantages, the choice of procedure may depend on the size and location of the defect, the presence of bony exposure with periosteal deficits, and the presence of cranial bone defects.

The frontal musculocutaneous V-Y island flap, whose blood supply is based on the vasculature within the frontal muscle, is one of the most reliable flaps for frontal or forehead reconstruction, even when other reconstruction procedures cannot be performed[6]. Here, we report a case of severe skin ulcer on the forehead, which was successfully covered through transfer of this flap.

Surgical Technique

The frontal musculocutaneous V-Y island flap was introduced by Rocha et al[6]. This flap is composed of unilateral or bilateral frontal muscles and a

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triangular flap of overlying skin. The blood supply of this flap is based on that of the frontal muscle, which is supplied by the supraorbital artery, the supratrochlear artery, and the frontal branch of the superficial temporal artery[5].

At flap elevation, the triangular flap of skin is marked across almost the entire forehead transversely to the skin defect. With the patient under general anesthesia and in the supine position, the cranial aspect of the skin incision is made along the hairline to the depth of the periosteum. Then, subperiosteal dissection proceeds caudally toward the supraorbital rim to detach the flap from the surface of the frontal bone. The plane between the periosteum and the surface of the frontal bone is relatively avascular, and the dissection proceeds easily as far proximally as is necessary to the supraorbital rim. Next, the caudal aspect of the skin incision is made to above the frontal muscle, and subcutaneous dissection is carried out between the subcutaneous layer and the frontal muscle. A "back-cut" release of the contralateral and cranial segments of the frontal muscle to the skin defect may be performed vertically to facilitate the advancement of the flap with less tension. Once the flap is confirmed to be easily transferable to the defect site, two-layered skin sutures are made primarily.

Case Presentation

A 56-year-old woman consulted our department for coverage of a forehead skin defect associated with dural exposure **(Fig. 1)**. She had previously been found to have a subarachnoid hemorrhage and then had undergone clipping surgery for a ruptured aneurysm through a left frontotemporal craniotomy. Subsequently, ventriculoperitoneal shunt insertion was performed to treat hydrocephalus resulting from the subarachnoid hemorrhage. Unfortunately, however, the bone flap became infected 5 months after the initial surgery and had to be partially removed. Consequently, surgical wound dehiscence occurred, and a subsequent skin ulcer, which was approximately 1 cm in diameter and was located around the bone defect, remained unchanged.

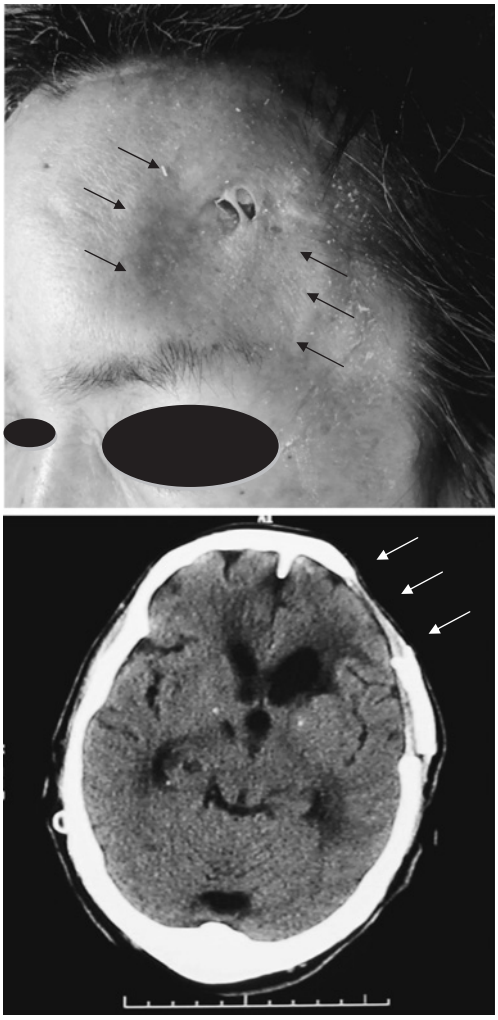

Fig. 1 56 year-old female exhibiting a skin ulcer with a dura and bone sequestrum exposure on her forehead. (above) Left oblique view. The area of the bone defect was noticed by the depressed region **(black arrow)**. (below) CT image showed cranial bone defect of the left frontal area **(white arrow)** and non-bony union between bone flap and the adjacent cranium.

The patient underwent forehead reconstruction with a 13 × 7-cm frontal musculocutaneous V-Y island flap **(Fig. 2)**. After debridement of the area around the ulcer, meticulous dissection between the dura and the flap was carefully performed at flap elevation. Although we did not confirm any major vessels that ran through the frontal muscle, slight bleeding was observed from the flap when the flap had been elevated. The fight side of the lateral border of the frontal muscle, which was approximately 5 cm in length, was partially transected as a "back cut" to facilitate flap

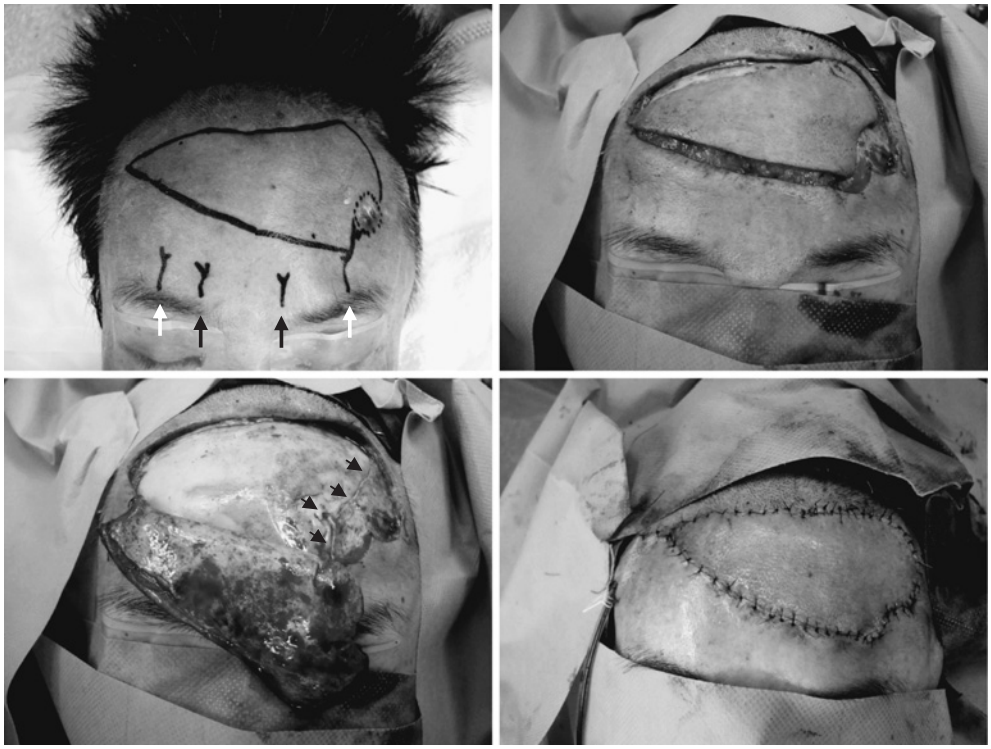

Fig. 2 Operative view (left above) Frontal musculocutaneous V-Y island flap which is 13×7cm in size was marked on the forehead. Black and white arrows show the supratrochlear arteries and the supraorbital arteries, respectively. (right above) After making a skin incision, flap was elevated from frontal bone. (left below) Back side view of the elevated flap. Moderate bleeding was found from the periosteum including the flap. Arrows showed the borderline of the cranial bone defect. (right below) Primary wound closure was successfully achieved without any complications.

advancement toward the defect. After a suction drain was placed beneath the flap, 2-layered primary wound closure was performed with 4-0 PDS® (Johnson & Johnson K. K., Tokyo) and 5-0 nylon. Total operating time and total bleeding were only 137 minutes and 50 mL, respectively.

All wound healing was quite stable and neither recurrence of the ulcer nor complications were found 3 months after the operation **(Fig. 3)**.

Discussion

A great variety of surgical reconstructive procedures can be used to repair defects of the forehead. Forehead reconstructive methods have evolved from skin grafting to flap transfer, including local forehead flap, periosteal flaps, island scalp flaps, expanded flaps, and free flaps[1–5]. Most plastic surgeons agree that facial defects should be closed with local flaps whenever practical, because local flaps are superior in terms of color matching, texture, and restoration of surface contour[7]. These qualities are particularly important for the forehead, where any mismatch would be conspicuous.

In the present case, operative procedures for reconstruction were limited, even though the ulcer was small. First, the ulcer could not be expected to be closed by either spontaneous granulation, by subsequent wound contraction, or by skin grafting because the underlying tissue was dura or bone sequestrum, which lack a blood supply. Second, regional skin flaps were also unavailable because the underlying vasculature was damaged by the previous craniotomy and infection. Free flap transfer could be considered if suitable recipient vessels had existed, but superficial temporal vessels, which might have been the most readily available candidate recipient vessels, were unlikely to be usable in this case because they were surrounded by scar tissue caused by the previous operation.

Fig. 3 Neither recurrence of the skin ulcer nor associated complications were found after 3 months of flap transfer. (above) Frontal view. Surgical scar seems acceptable. (below) Left oblique view.

Consequently, we concluded that a frontal musculocutaneous V-Y island flap was the only choice. Although many surgical series have been reported, all cases involved immediate reconstruction after extirpation of malignant skin tumors. On the other hand, the present case is, to our knowledge, the first reported case of successful reconstruction with the same procedure used to treat intractable ulcer caused by repeated craniotomy.

The blood supply of the frontal musculocutaneous V-Y island flap cab be divided into three parts: the frontal branch of the superficial temporal artery, the segmental branch of the supraorbital artery, and the segmental branch of the supratrochlear artery[5]. These 3 vessels may nourish different parts of the frontal muscle and its overlying skin. However, the blood supply of the entire flap is stable if the flap is elevated from a wide area of the entire forehead.

There are some technical concerns for elevating the frontal musculocutaneous V-Y island flap. The incision line should be as transverse as possible because the natural wrinkles of the forehead run transversely. The temporal branch of the facial nerve should not be damaged when a vertical skin incision is made along the reconstructed lesion. Therefore, muscle incision should be continued 1 to 1.5 cm cranially from the lateral eyebrow.

The advantages of the frontal musculocutaneous V-Y island flap include: (1) it is technically feasible and requires only a short operation time, (2) the blood supply of the flap is stable, (3) the function of the frontal muscle is preserved as long as the temporal branch of the facial nerve remains intact, (4) it is a sensory flap because the supraorbital nerve is included, (5) it is superior in both texture and color match, and (6) the donor site can be closed primarily. On the other hand, disadvantages of the flap include: (1) an oblique incision is unavoidable, (2) sensory loss of the frontoparietal region occurs because the supraorbital nerve is completely transected at flap elevation, and (3) the range of flap advancement is limited by the preservation of the frontal muscle. Nevertheless, the frontal musculocutaneous V-Y island flap may be more useful for even extensive reconstructions than are other flaps, such as free flaps.

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(Received, August 1, 2008)
(Accepted, October 17, 2008)